

## Atlas of the Carpathian macroregion

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# Atlas of the Carpathian Macroregion

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## Abstract

This article presents selected topics of the Atlas of the Carpathian Macroregion. By means of over 40 maps and figures of the most important socio-economic and natural indicators as well as concise interpretations, the Atlas shows the developments over the last 20 years as well as visualising disparities within this heterogeneous and changing region. The University of Olomouc and EURAC research elaborated this Atlas together within the scope of the Carpathian Project (EU INTERREG III B CADSES). The atlas represents an extensive harmonised database focused primarily on the socio-economic aspects of the Carpathian space. It presents the region's advantages and potentials, and addresses the challenges of region in an innovative and coordinated manner. The Atlas of the Carpathian Macroregion contributes to the overall analysis of the Carpathian region and facilitates the implementation of the Carpathian Convention by the policy makers. In addition, the Atlas of the Carpathian Macroregion represents a tool helping to develop the follow-up activities in the Carpathian space providing comprehensive and concise information base for areas such as population development, tourism development, cultural heritage, transborder cooperation etc.

*Carpathian Macroregion, atlas, maps and figures, socio-economic and natural indicators*

## Zusammenfassung

### Atlas der karpatischen Makroregion

Dieser Artikel behandelt ausgewählte Themen des Atlases der karpatischen Makroregion. Anhand von mehr als 40 Karten und Abbildungen der wichtigsten sozio-ökonomischen und natürlichen Indikatoren mit kurzen prägnanten Interpretationen zeigt der Atlas die Entwicklungen im Verlauf der letzten 20 Jahre und veranschaulicht dabei die Disparitäten innerhalb dieser heterogenen und sich verändernden Region. Die Universität von Olomouc und die EURAC-Forschung erarbeiteten diesen Atlas gemeinsam im Rahmen des Karpaten-projektes (EU INTERREG II B CADSES). Der Atlas bildet eine umfassende harmonisierte Datengrundlage, die hauptsächlich die sozio-ökonomischen Aspekte des Karpatenraumes erfasst. Er zeigt die Vorteile und Potentiale der Region und beschreibt in innovativer und koordinierter Form die Herausforderungen der Region. Der Atlas der karpatischen Makroregion trägt zur Gesamtanalyse der Karpatenregion bei und erleichtert den Politikern die Umsetzung der Karpatenkonvention. Ferner ist der Atlas der karpatischen Makroregion ein Instrument, das durch eine umfassende und solide Informationsgrundlage für Bereiche wie Bevölkerungsentwicklung, Tourismusentwicklung, Kulturerbe, grenzüberschreitende Kooperation usw. zur Entwicklung von Folgemaßnahmen in dem Karpatenraum beiträgt.

*Karpatische Makroregion, Atlas, Karten und Abbildungen, sozio-ökonomische und natürliche Indikatoren*

## Introduction

This article presents selected topics of the Atlas of the Carpathian Macroregion. This large mountain region represents one of the most important biodiversity hotspots in Europe. At the same time the region experiences comprehensive changes in all sectors since the collapse of the old political system. The Atlas attempts to document those changes as well as showing the current situation. By means of over 40 maps and figures of the most important socio-economic and natural indicators as well as concise interpretations, the Atlas shows the developments over the last 20 years as well as visualising disparities within this heterogeneous and changing region.

The main challenge for the Carpathian Region is to manage those significant changes to achieve a sustainable eco-

nomic prosperity without the loss of its natural and cultural characteristics. The Atlas was elaborated in the context of the International Framework Convention on the Protection and Sustainable Development of the Carpathians. The convention, agreed under the lead of UNEP/REC-Vienna, aims towards a sustainable development of the Carpathian mountain region. The University of Olomouc and EURAC research elaborated this Atlas together within the scope of the Carpathian Project (EU INTERREG III B CADSES). The Carpathian project integrated European spatial development policies with the management of the Carpathians' fragile mountain ecosystems in a transnational context. Some representative maps and topics were selected to give a better picture of Carpathian Macroregion.

## Carpathian Macroregion delimitation

The Carpathian Macroregion (CM) extends for approximately 450,000 km<sup>2</sup> and stretches beyond the area of the Carpathian Mountains. It includes eight countries: Austria, the Czech Republic, Hungary, Poland, Romania, Serbia, Slovakia and the Ukraine. The Macroregion is defined according to the administrative regions of the Carpathian area in order to have a larger analytical database and to enable the participation of regional governments and their entire administrative areas within the project. Each of the Carpathian countries has a distinct administrative division originating from its individual historical development and contemporary view of effective administration. Despite considerable differences in number, size and autonomy level of in-



Fig. 1: Administrative division (NUTS 3) of the Carpathian Macroregion  
Source: Atlas of the Carpathian Macroregion

dividual administrative units, a comparison is possible through the EU NUTS (Nomenclature of Territorial Units for Statistics) and LAU (Local Administrative Units) systems, which are defined in all Carpathian countries aside from Serbia and the Ukraine. For Serbia and the Ukraine, data from local administrative units were used where available. Austria is a federal country comprised of nine self-governing regions (*Bundesländer*). The other Carpathian countries are unitary states with varying levels of decentralisation. The lowest units are always self-governing municipalities. Between the municipality and state level are one or two hierarchical levels of administrative territorial units, out of which one level (NUTS2 or NUT3) is typically self-governing: in the Czech Republic they

are the *kraje*, in Hungary, the *megyék*, in Poland, the *województwa*, in Romania, the *județe*, in Slovakia, the *kraje* and in the Ukraine, the *oblasti*.

### Natural Conditions

The Carpathian Macroregion is most significantly influenced by the Carpathian mountain chain. The name “Carpathians” was first recorded as *Karpates oros* in the second century by the Greek astronomer and geographer Ptolemy. Similar to the Alps, the Carpathians have risen from a Mesozoic geosynclinal sea. The curved shape of the Carpathian range is due to the presence of older, more resistant parts of crust. These are the Bohemian Massif in the northwest, the Ukrainian shield in the northeast and the Moesian platform in the southeast,

called the Tisia Massif (in the Danube basin). The folding of the mountains occurred in several stages and was completed in the Tertiary. The Southern Carpathians folded during the final phase.

### Geology

The Carpathians are made up of three geological belts. The outer flysch belt is composed of sedimentary rocks such as sandstone, claystone and pudding stone. The central belt consists of metamorphic and igneous rocks and it is here that the highest peaks of the mountain range are found. The inner belt is composed of mainly volcanic rocks, typical of the Western Carpathians. In the Eastern Carpathians, the flysch belt is more developed. The central belt only occurs within the massifs near the Romanian-



Ukrainian border. The inner volcanic belt is strongly represented, running continuously from the Slovak Vihorlat to Romania. The Southern Carpathians lack both the outer flysch and the inner volcanic belt. This entire area has risen since the Pliocene by approx. 1,000 m and the tectonic lift continues in some areas. It is mainly in the Eastern Carpathians where the dynamic development becomes apparent in earthquakes. The area of Carpații de Curbură in the Arc Carpathians experiences frequent seismic activity. A catastrophic earthquake (magnitude 7.2) with its epicentre at Munții Vrancei hit the region on March 3, 1977, claiming over 2,000 lives. On the inner side of the curved Carpathian mountain range lies the Pannonian Basin, created in the catchment of the Danube. It covers the Paleozoic Tisia Massif. This area was submerged by Mesozoic and Tertiary seas, as evidenced by existing sand and clay sediments that reach 3,000 m in thickness. The area subsides and is filled with Quaternary sediments, reaching depths of 1,000 m in Alföld. The outer side of the Carpathian chain from Austria to Romanian Moldavia is known as the Outer Carpathian depression. It bears sea sediments and is also covered by Quaternary fluvial and eolic sediments.

### Geomorphological Division

To this day, no consistent geomorphologic division of the Carpathians exists. In the Czech Republic, Slovakia and Poland, categorization into the Western, Eastern and Southern Carpathians is common. Romanian geography distinguishes Northern, Eastern, Southern and Western Carpathians, with the latter describing the range between the rivers Someș and Danube. The Predeal pass is regarded as the divide between the Eastern and Southern Carpathians. The Carpathians are characterised by a mid-mountainous relief shaped by rivers and slope erosion. The highest peaks of the Carpathians are currently being lifted up by 4-10 mm/yr. Pleistocene glaciations occurred in the Tatras, Munții Rodnei, Munții Călimani, Munții Făgărașului, Munții Parângului and Munții Retezatului. The Pannonian Basin within the Carpathian chain exhibits lowland character, with Alföld (Great Hungarian Plain) forming the main part of the basin. The Transylvanian Plateau in 500-600 m a. s. l. is an independent area and represents

the largest inner basin of the Carpathians. The lower Danube lowland Câmpia Română (or Vlaška nizija) is the collective name given to the lowlands along the lower Danube from the Iron Gate.

### Climate and Hydrology

The climate of the Carpathians and its surrounding lowlands and basins is rather continental. The Carpathian mountain range, however, is more humid than the lowlands and basins. Precipitation levels rise with altitude and decrease from west to east. The western regions record an average annual precipitation of 700-800 mm, while the southeastern regions average 350-400 mm and mountainous areas average 1,000-1,200 mm (up to 2,100 mm in the Tatras). Virtually the entire area belongs to the Black Sea catchment (the Danube), with only the northern and northwestern parts (Odra/Oder) belonging to the Baltic Sea catchment. The largest river is the Danube. The largest lakes are situated in the Pannonian Basin: Balaton measuring 592 km<sup>2</sup>, Neusiedlersee/Fertő-tó at 221 km<sup>2</sup> and Velencei-tó at 27 km<sup>2</sup>.

### Nature Conservation

In the Carpathian Macregion, natural areas protected at the national level have the status of national parks, protected landscape areas or nature reserves. The majority are linked to areas of cultural or primeval forests. While *national parks* are designated in all Carpathian countries, other types of protected areas differ slightly. The Czech Republic, Slovakia, Poland, Romania, and Serbia designate *nature reserves*. A similar category, *nature zapovednik*, is designated in the Ukraine, and in Hungary, *nature conservation areas* are identified. *Forest reserves* are also designated in Hungary and Romania. Romania, however, also protects certain areas as *scientific reserves*. In the Ukraine, the term *national biosphere zapovednik* is used. *Protected landscape areas* are designated in Austria, the Czech Republic, Slovakia, Poland, and Hungary, *nature parks* in Austria, Romania, and Serbia, and *landscape parks* in Poland, Ukraine, and Serbia.

### Natural and Anthropogenic Risks and Hazards

#### Soil Erosion

Soil erosion by water, wind and tillage affects both agriculture and the natural environment. The impact of soil loss is

one of the most pressing environmental problems. The most extensive and severe wind erosion occurring in Romania and Ukraine (steppe formation – collective open fields). Moderate wind erosion areas exist in southern Moravia (Czech Republic) and Hungary. Water erosion, such as sheet and rill erosion, occurs less in this region.

### Seismic Activity

The seismic hazard map (SHAP) shown in Figure 3 was taken from the SHAP of the larger Europe-Africa-Middle East region, itself part of the global GSHAP hazard map. The seismic hazard values indicate peak ground acceleration with a 10 % probability of exceedance in 50 years. It is obtained by combining the results of 16 independent regional and national projects. The region is influenced by a highly active tectonic zone in the East Mediterranean Region. The highest risk area is located in Romania, with a particularly active seismic Vrancea region in the south-east of the Carpathians. This region is among the most active in Europe. The strongest earthquake ever recorded here was on January 23, 1838 and occurred at a depth of 70-80 km. Other zones are connected to active tectonic zones by deep faults. There are other active zones in the Pannonian Basin, where the Komárno earthquake occurred on June 28, 1763. Generally, the seismic activity in the region is connected to the tectonic uplift of the Carpathian and Alpine mountain regions.

### Land Use

The CORINE land cover data was used in the analysis. This data, provided by the European Environment Agency, does not cover Ukraine. Totalling the land use values for the Carpathian Macregion excluding Ukraine revealed that over 55 % of the area is used for agriculture (arable land, vineyards, trees plantations, pastures, etc.). Approximately 38 % is covered by forests, delineated as follows: 57 % broad-leaved forest, 23 % coniferous forest, 20 % mixed forest. Most of the forests coincide with the Carpathian mountain range. Over 6 % of the area has been developed or has a potential for settlement, and over 1 % is covered by bodies of water and wetlands.

The CORINE programme also provides data on land cover changes, which took place between 1990 to 2002. This data identifies areas where both signifi-



Fig. 2: Protected areas  
Source: Atlas of the Carpathian Macroregion

cant and minimal changes in land use took place. Although the changes affect only 2 % of the total area, they indicate future development trends that may affect the landscapes in this region.

Austrian territory within the area of interest experienced only minor changes due to minimal social and land ownership variations. A similar situation prevails in Poland, although land usage did change in the regions of Bielsko-bialski, Krakowski, Nowosądecki, Krośnieński and Rybnicki. Despite a radical change in Poland's political regime, land use changes were not as apparent here as they were in other former socialist countries. The reason for this is a differing land ownership system. In Poland, collectivisation of agriculture was not real-

ised and small land holdings were kept. Polish agriculture and landscape cultivation was maintained during socialism, which is reflected in the minimal land use changes between 1990 to 2000.

The greatest landscape structure changes are seen in the Czech Republic, Slovakia and Hungary, due to several key factors. The first factor is transfer of land ownership (restitutions). The second is the reduction of landscape cultivation subsidies which during the socialist period were applied unilaterally without respect to climatic or soil conditions. The third factor is a lucrative subsidy policy provided during the 1990s that encouraged the grassing of agricultural land in areas less suitable for plant production. The fourth factor involves the method of forest management in countries of

the former Austrian-Hungarian Empire where clear cutting was common. After reaching harvest age (between 70 to 160 years), entire areas were cut and new trees planted. Newly planted forests, however, are not identified as forests on aerial and satellite images, which were the basis for the CORINE data. These areas were therefore classified as "scrub or herbaceous vegetation".

Assessing future landscape development, several trends can be identified. As regional economies evolve throughout the area of interest, artificial surfaces are expected to increase, especially in low-land areas near cities. In post-communist countries those areas have been growing exponentially at the expense of arable land. In Poland, the Czech Republic, Slovakia and Romania, developments



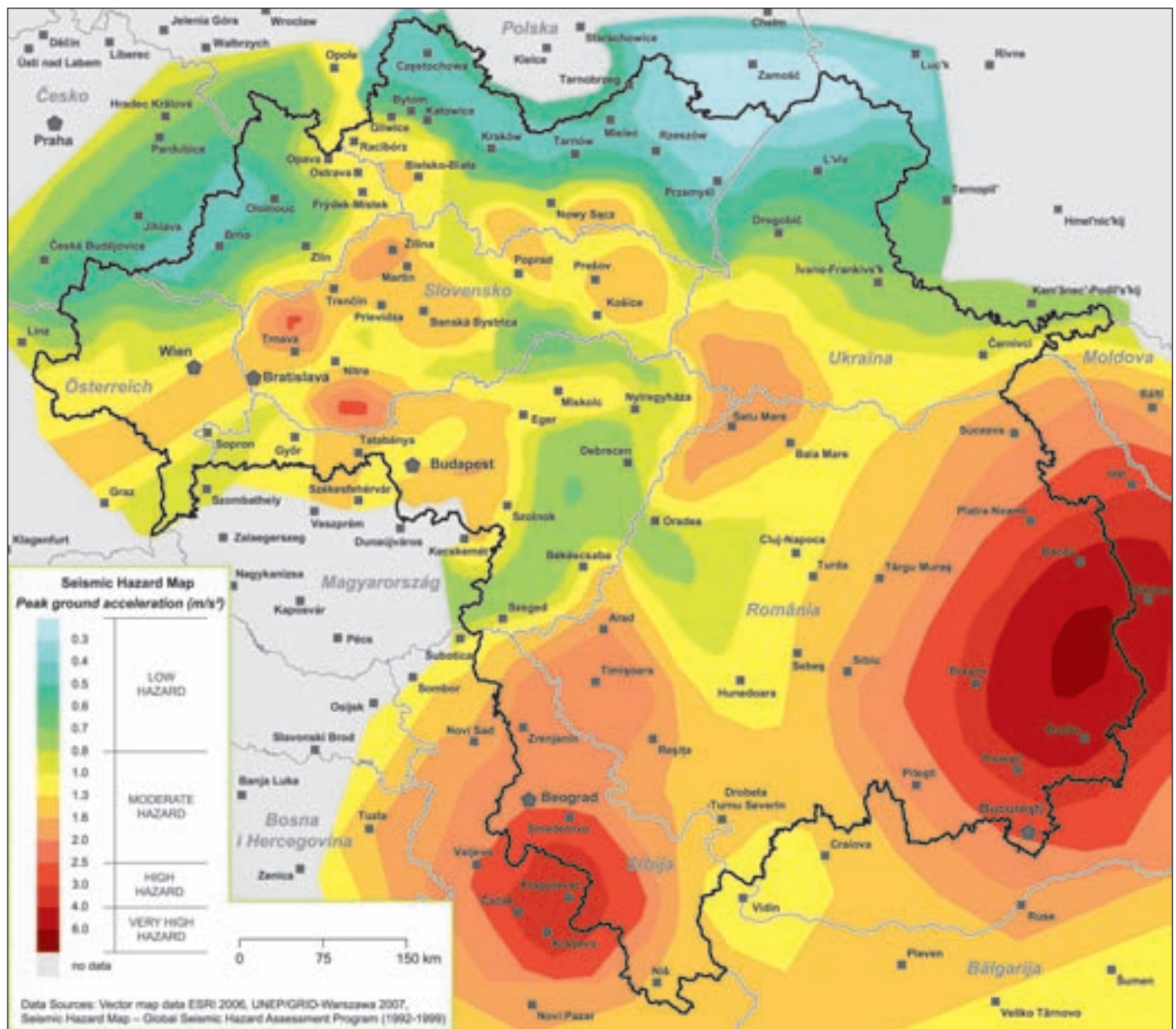


Fig. 3: Seismic Hazard Map  
Source: Atlas of the Carpathian Macroe region

manifested themselves in suburbanisation and the construction of new traffic infrastructures. Pressure to increase the availability of arable land for the production of plants that enhance alternative sources of energy can be expected.

### Age Structure

Declining fertility rates and increasing life expectancy have contributed to a significant ageing of Europe's population. If on the one hand an ageing population can be seen as one of humanity's greatest achievements, on the other hand elderly people are frequently considered a costly burden, especially in terms of healthcare and social security expenditure. In rural areas the autonomy of elderly people may be compromised by the remoteness of their place of residence, by difficult

access to the same and by the disappearance of shops and services in small depopulating municipalities. Furthermore, outward migration of younger family members can put them in a vulnerable position in terms of access to official services and the availability of informal assistance from outside the home when this is needed.

The phenomenon of ageing is thus a big challenge for modern societies. It can be measured through the old age index, a dynamic indicator that describes the demographic structure of a region and consists of the ratio of the over-64 to the under-15 population, multiplied by 100. The average old age index in the area under study was 89.4 in 2005, a value which was significantly lower than that of the Alpine Convention Area

(100.3). It was higher in the Serbian and in Austrian Carpathians and lower in the Ukrainian and Slovak Carpathians. The old age index value reflects the differential impacts of longstanding patterns of rural-urban and urban-rural migration. In 2005 the distribution of the old age index was rather uneven and achieved its highest values in the easternmost and southernmost areas of the Carpathian Macroe region.

Higher proportions of older people in rural areas result from two general processes. On the one hand, there are areas which are ageing as a result of significant outward migration of younger people. Examples are the Serbian districts of Zajecarski, Pomoravski and Branicevski, where in 2005 the old-age index reached levels of 240, 177 and 172

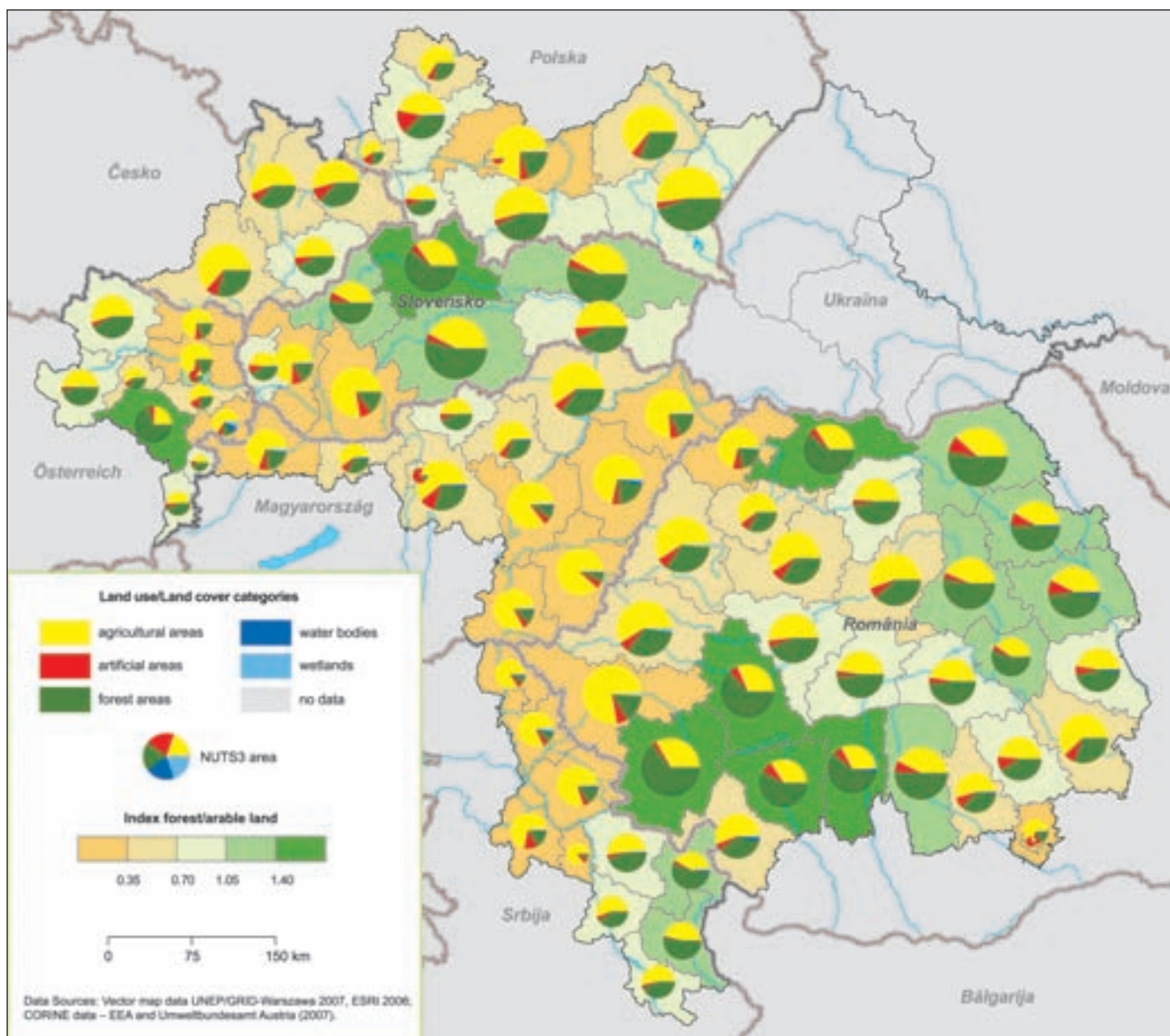


Fig. 4: Land use  
Source: Atlas of the Carpathian Macroregion

respectively. In these areas the political and economic crisis of the 1990s and the negative effects on the labour market of privatization and economic restructuring augmented the brain-drain phenomenon. On the other hand, there are areas where the high old age index is the result of the inward movement of older people following retirement. Two examples are Burgenland and Waldviertel, which host many elderly retired people who have converted their summerhouses into permanent residences in order to enjoy the better quality of environment. The Ukrainian oblasts constitute a special case in which the old age index is affected by relatively low life expectancy at birth, amounting to only 62 years for males and 74 for females in 2003. The causes of this can

be attributed both to the decline of the healthcare system following the 1998 Russian economic crisis and the abuse of tobacco and alcohol.

### Educational Structure

The Education Index expresses the general level of education of a population, including all levels of education from primary to tertiary. The definition of the Educational Attainment Index (EAI) stems from the relative significance of four individual educational categories and is calculated as follows:  $EAI = 1 \times PE + 2 \times SE + 3 \times SES + 4 \times TE$ , where PE is the proportion of the population with primary educational level, SE represents the population with secondary educational level without the school-leaving examination, SES is the

share of the population with secondary educational level with the school-leaving examination and TE represents the proportion of the population with a tertiary education. Thus the index can have a value from 1 to 4 where a value of 1 refers to all population having a primary educational level and a value of 4 means all population having attained a tertiary education. An important consideration is the national definition of each level of education which, in general, favours post-communist countries and penalizes Austria. Post-communist countries, especially Ukraine, consider graduates of post-secondary technical schools tertiary education graduates. This practice is not used in Austria. It is therefore important to stress that the results are not fully comparable.



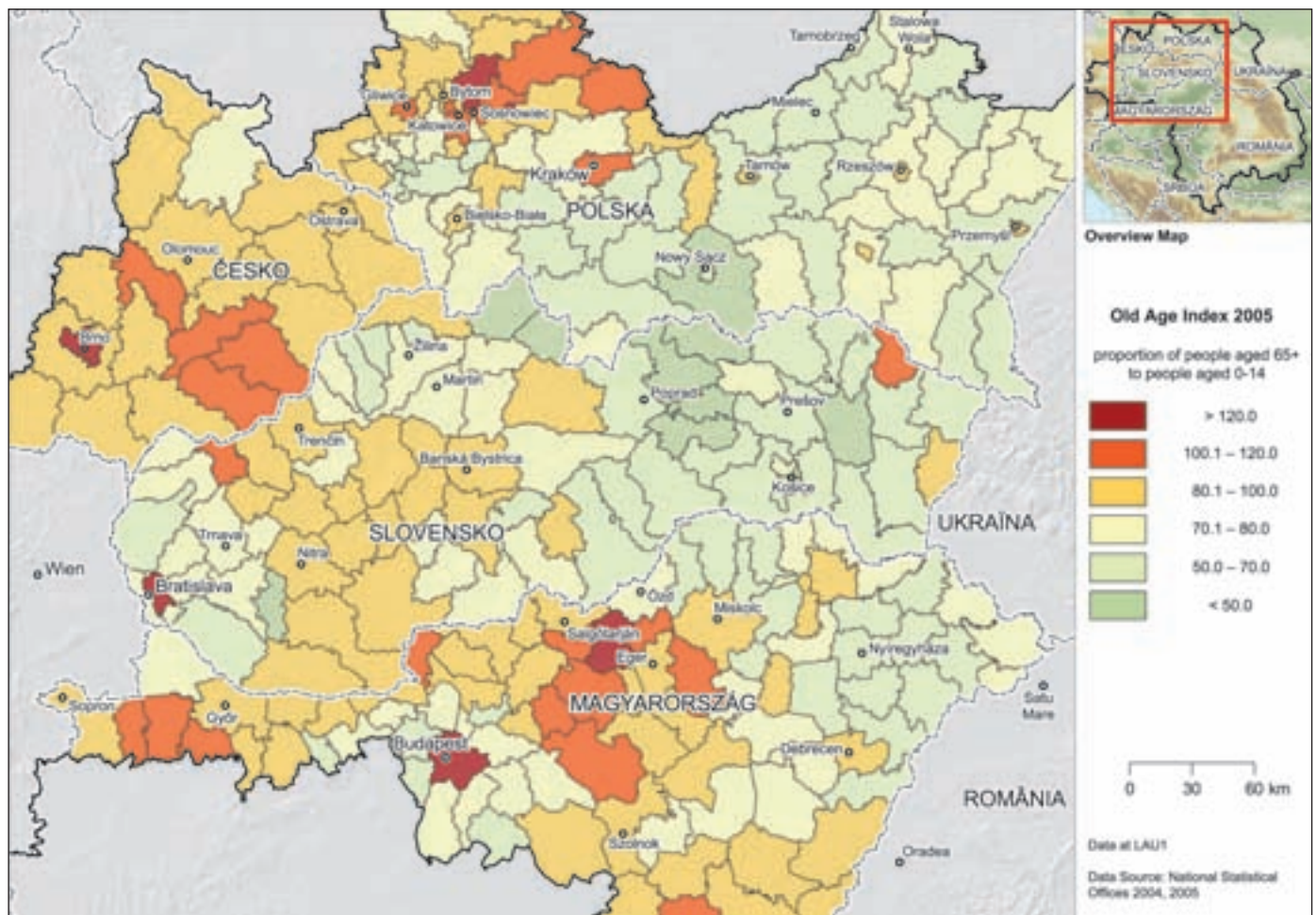


Fig. 5: Old Age Index 2005  
Source: Atlas of the Carpathian Macroregion

Throughout the 87 regions of the Carpathian Macroregion, the index of educational attainment varies from 1.42 (Braničevski okrug) to 2.60 (Bratislavský kraj and București). Fifty-four (54) regions, representing 62 % of the interest area, showed a value larger than 2.00. It should be noted, however, that some values in Ukraine are misrepresented: the Ukrainian census data does not differentiate between secondary education with or without the school-leaving examination; secondary education was regarded as one category and was assigned the significance of 2.50. The result of this index is thus likely heightened. In fact, a higher proportion of population with secondary education without graduation exam may be assumed.

The highest index values are reached in the metropolitan regions of București, Bratislavský kraj, Budapest (all 2.60) and Kraków (2.59). These are followed by the regions of L'vivs'ka oblast', Brașov and Košice. Other significant metropolitan areas rank lower: Jihomoravský kraj (2.24) in 11th place, Beograd (2.13) in

29th place and Wien (2.07) in 43th place. Significant distribution of secondary education without the school-leaving examination may be one reason why these regions rank a lower education index. In the metropolitan region of Wien, a third of the inhabitants have only a primary educational level. Generally, regions ranking 6th through 20th show a high proportion of secondary education and a relatively low proportion of both primary and tertiary levels of education. As the proportion of secondary level of education without the school-leaving examination rises, the value of the index descends and the population with primary educational level increases.

The lowest values of the index are found in those regions where the population with primary educational level dominates (more than 45 %) and where a significant proportion of population has attained secondary education without the school leaving examination. The two remaining categories of higher education have maximum proportion of 9 %. A significant concentration of regions

with lower levels of education is found in Serbia (1.42).

### Cultural Heritage

In the last 10 years the number of UNESCO World Heritage cultural sites in the Carpathian Macroregion has doubled. By 2007 there were 30 listed cultural and natural sites the Carpathian Macroregion. Only cultural sites which can demonstrate outstanding universal value and uniqueness can be listed. A given heritage site must meet at least one of ten selection criteria. By ratifying the UNESCO World Heritage Convention each country pledges to conserve World Heritage Sites situated within its territory and to preserve its national heritage. The World Heritage Convention has been in existence since 1972. More than two-thirds of all UNESCO sites are clustered in the western Carpathians. The fact that there are fewer listed World Heritage sites in the eastern Carpathians does not necessarily mean that there are fewer sites of outstanding value. One possibility is that certain countries have



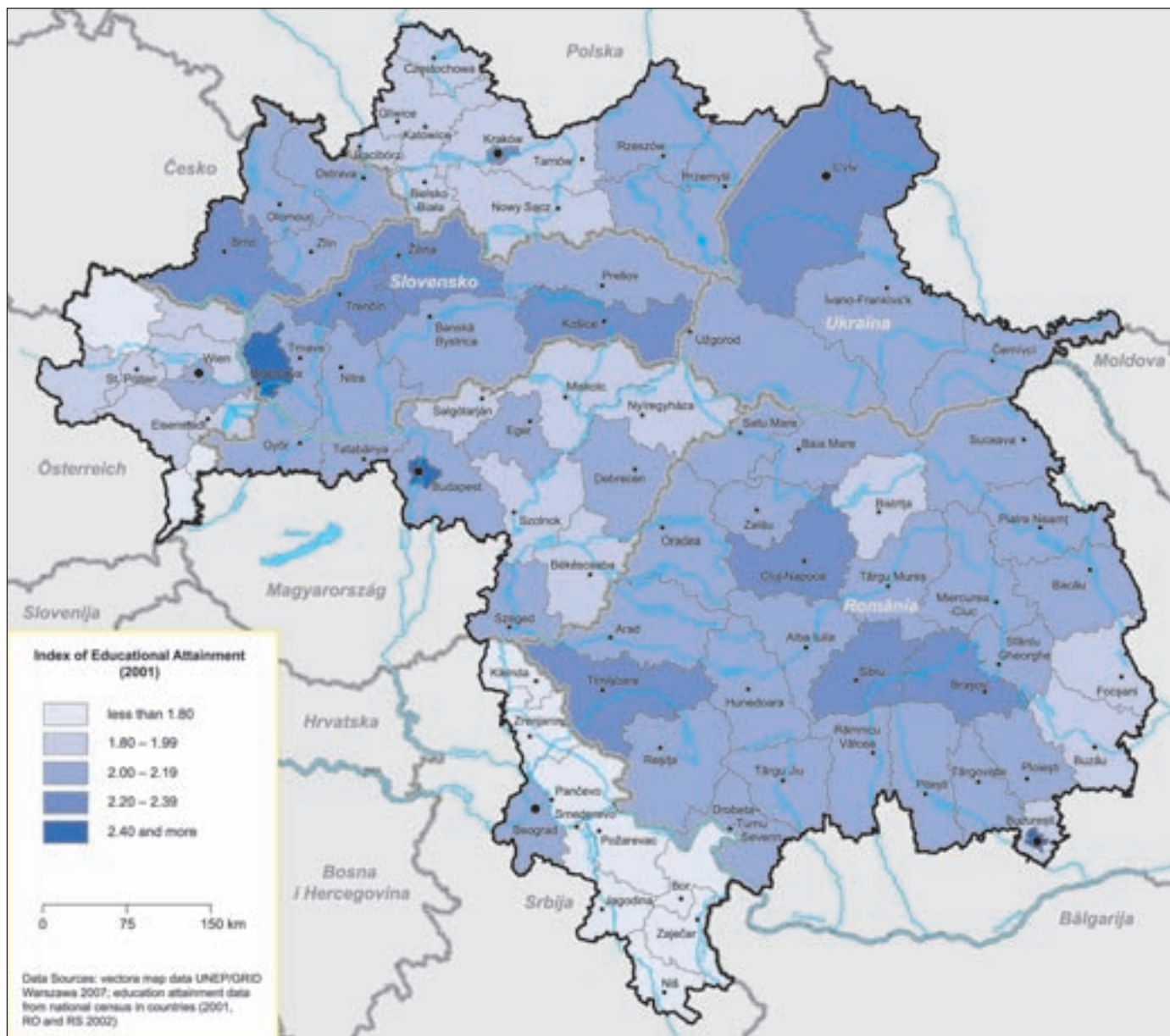


Fig. 6: Index of Educational Attainment 2001  
Source: Atlas of the Carpathian Macroregion

to date been more active in applying for and successful in obtaining listing for their sites. Romania only ratified the World Heritage Convention in 1990. As part of the former Yugoslavia, Serbia has been a member of the Convention since 1975. One of the three UNESCO World Heritage cultural sites in Serbia is located within the Carpathian Project Area. Apart from five sites in Hungary and Poland, all listed cultural sites within the Carpathian Macroregion were listed after 1990. That fact and existing literature on the matter would seem to indicate that increasing efforts aimed at the restoration and protection of heritage sites of regional and national value have been made since the 1990s. In the pre-1989 era economic and political conditions, lack of

funds, and certain ideological views (e.g. Ceaușescu's plans to transform Romania into an urban society, with the demolition and replacement of vestiges of traditional heritage) may also explain that comparatively fewer listed UNESCO sites are to be found in the eastern Carpathians. There are 30 UNESCO listed sites including 6 cultural landscapes. By far the oldest UNESCO site in the Carpathians is the Dacian Fortress complex in the Orastie Mountains in Romania. The fortresses date from the 1st centuries B.C. and A.D. and show an unusual fusion of military and religious architectural techniques and concepts from the Classic and Late European Iron Age. A total of 4 UNESCO sites are located within the comparatively small Austri-

an part of the Carpathian Macroregion. They include 2 cultural sites and 2 cultural landscapes. The Fertő/Neusiedlersee cultural landscape stretches across the boundaries of 2 states (Hungary and Austria). Although much smaller than the Romanian area, the Hungarian Carpathians boast the same number of 6 listed sites. It is striking that 4 out of the 6 of Romanian sites are related to church/monastery architecture.

### Tourism Development

Tourism development can be an important agent of economic development in rural areas, helping to revitalize local economies and improve quality of life by providing supplementary income in the farming, crafts and service sectors.

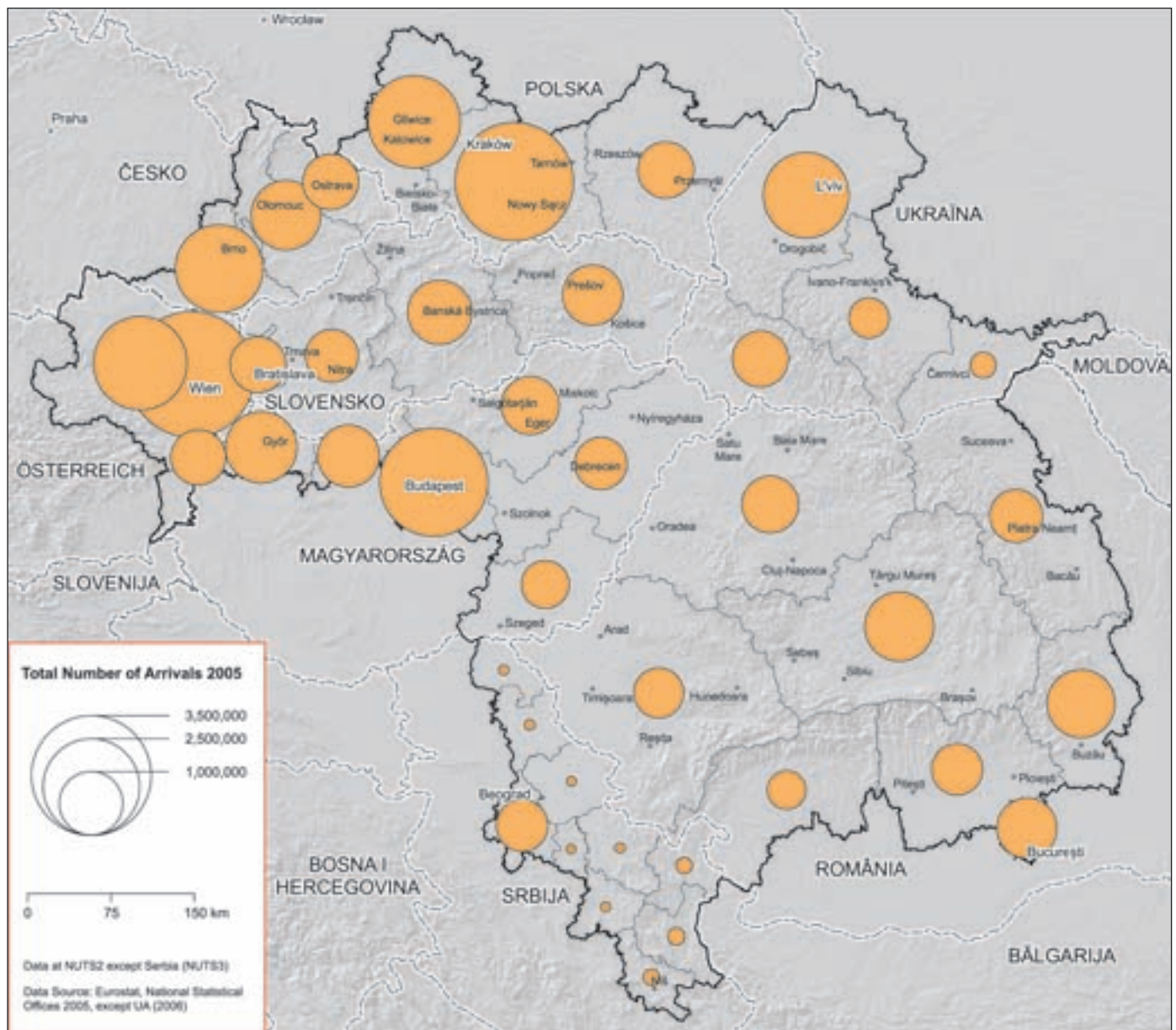


Fig. 7: Total Number of Arrivals 2005  
Source: Atlas of the Carpathian Macroregion

It also provides opportunities for re-evaluation of local heritage, symbols and rural identity, and encourages new micro-business growth. Tourism, however, does not have the same positive impact in all mountain regions. Apart from the ecological risks involved in intense tourist activity in vulnerable environments such as mountain ecosystems, tourism can be a relatively unreliable factor in the development of mountain regions for a number of reasons. Inward investment and the creation of new companies and employment can be limited owing to the small-scale and dispersed nature of the tourism industry, which generally yields low returns. Moreover, for tourism to be successful it requires multiple skills, yet it is often managed by rural entrepreneurs such as farmers, small town/

village businessmen and local officials, who may not have specific training in tourism.

The Carpathian countries have considerable tourist potential, with their rich natural and cultural heritage. Development is however hampered by sub-standard facilities, low technical and tourist management skills and poor general infrastructure and accessibility. Due to the large variety within the Carpathian Macroregion the following kinds of tourism have potential, depending on the landscape and regional characteristics:

- *environmental tourism*, including sports activities such as skiing, walking, trekking, hiking, nature excursions, etc;
- *health and wellness*, which like en-

vironmental tourism is more typical of mountain areas and includes spas, mineral and thermal springs;

- *cultural and congressional tourism*, involving museums, historical sites, theatres, festivals, workshops, etc;
- *business tourism*, involving trade events, business fairs, business conferences, which like cultural tourism is more typical of the city areas;
- *agrotourism*, practiced in most rural areas.

In 2005 the Carpathian Macroregion was visited by almost 40 million people, a relatively high figure greatly influenced by the presence of large cities such as Vienna, Krakow and Bucharest, which are not strictly-speaking Carpathian, but which border on the Carpathian area.



### Small and Medium Enterprises

Information sources on small and medium enterprises are derived from the databases of national statistical offices on the basis of an internationally comparable classification. Definitions of a statistical unit (enterprise) in the European registers of economic subjects (RES) are harmonised by EP and EU Council regulations (No. 696/1993 and 177/2008). The branch structure stems from a simplified form of branch classification of economic activities valid in the EU called NACE, which allows a comparison between member states and, to a certain extent, among other European states. Analysis data are found in NACE Rev. 1.1 version and remains consistent with revisions to the 2006 statistical classification NACE Rev. 2 under EU regulation. For the sake of transparency, NACE categories were united into three main economic sectors – primary, secondary and tertiary. Detailed branch classification is carried out within this framework. Data acquired for five countries are presented at NUTS3 and, in case of Romania, at NUTS2. Due to a lack of regional data for Serbia there is only one national value. Data for Ukraine and Austria were not accessible. To compare data between the countries, two categories of enterprises were created to best reflect internationally acknowledged size categories: small enterprises (1-19 employees, where enterprises without employees were excluded) and medium enterprises (20-249 employees). The absolute data on the number of enterprises according to size were related to the number of employed persons older than 15 years.

Small enterprises represent the most flexible branch of the enterprise structure. Of the five countries, the highest concentration was recorded in Poland. In all regions, the scale of employment in small enterprises exceeded 150 enterprises per 1,000 employed persons. In the case of regions Bielsko-bialski, Centralny śląski, Częstochowski, Nowosądecki and Kraków, it exceeded the level of 200 enterprises. Levels exceeding 100 enterprises per 1,000 employed persons were reached only by the metropolitan regions of Budapest and

Bratislavský kraj. In the remaining area, the largest intensities were reached in the Czech Republic. In Slovakia, Hungary and most of Romania, numbers do not reach the level of 50 small enterprises per 1,000 employed persons.

The lowest value is recorded in Sud-Vest Oltenia with 34 enterprises and the value for Serbia is negligible (3 enterprises per 1,000 employed persons). For classification purposes, the majority of these companies are concerned with trade and real estate, with the exception of Romania where transport companies are also included.

The largest intensity of medium enterprises (up to 250 employees) was registered in the regions of the Czech Republic, where the mean value exceeds 10 medium enterprises per 1,000 employed persons. In Jihomoravský kraj and Zlínský kraj this value approached 20. Half values are reached in the metropolitan regions of Kraków, Budapest and Bucureşti (including Ilfov). Apart from these areas, higher intensity (5-6 enterprises per 1,000 employed persons) was registered throughout Slovakia and in the Romanian regions of Centru and Vest. The lowest values were recorded in Serbia with just 1 enterprise per 1,000 employed persons. In terms of branch structure, service sector enterprises dominated (trade, education and real estates), although in half of Polish, two thirds of Hungarian and one third of Romanian regions, secondary sector enterprises prevailed. Significant concentrations of agricultural production are represented by higher proportions of agricultural enterprises among medium enterprises in the Czech Republic, with all regions registering more than 350 medium enterprises. Respective values reaching 100 enterprises were recorded in Romania and Slovakia.

### Density of Network and Accessibility

Since the Carpathian Macroregion includes the territory of eight countries, borders play an important role for transport and accessibility. Figure 9 represents the most important rail, road and water border crossings in the region. The highest density of border crossings occur on the borders between the Czech Republic with Slovakia and Poland, and also between Austria and Hungary. Local border crossings are important, contributing to economic development and, particularly, tourism. On December 21, 2007, four new member states (the Czech Republic, Hungary, Poland, and Slovakia) entered the Schengen space and the number of crossing points rose substantially. Outside the Schengen border, how-

ever, crossings are now guarded more stringently and a lower level of border permeability is now experienced, particularly in the cases of Serbia and Ukraine.

### Traffic corridors

A number of important international corridors for transportation exist within the Carpathian Macroregion. In 1994, ten important European traffic corridors, crossing the region of Central and Eastern European (post-communist) countries were designed in Crete and is called the Trans-European Network (TEN). In the Carpathian region most of those corridors serve to bypass the main arc of the Carpathians. The Carpathian mountains are in fact a traffic barrier. The northern branch of the 5th corridor follows the Western Carpathian mountain chain, connecting Bratislava, Žilina and Košice with Ukraine. The northern branch of the 4th corridor crosses the South Carpathians, connecting Budapest and Constanţa via Transylvania and Bucharest. The most important hub of TEN corridors in the Carpathian Macroregion is Budapest.

### Airports

Twenty-nine (29) international airports are located in the Carpathian Macroregion, the largest of these being located in capital cities. Wien Schwechat is the largest airport in the region, serving approximately 17 million passengers in 2008. Budapest Ferihegy is the second most important airport in the region, followed by the Belgrade and Bucureşti Otopeni airports. In the Polish region of the Carpathians, Kraków airport is the most important. In Slovakia, Bratislava has the largest airport. The importance of Brno and Ostrava airports in the Czech Republic is far less than that of Vienna and Prague. Although in Romania, international airports beyond Bucureşti Otopeni and Bucureşti Băneasa are also important for domestic flights. Timişoara has the largest airport outside Bucharest. In Ukraine, international airports are located in L'viv and Ivano-Frankiv'sk. In recent years, a substantial rise of air traffic in the region has been observed.

### Oil and gas pipelines

The Carpathian region is an important transit region for the transportation of gas and oil. The backbone for oil transportation in the region is the southern branch of the Druzhba pipeline, originating in

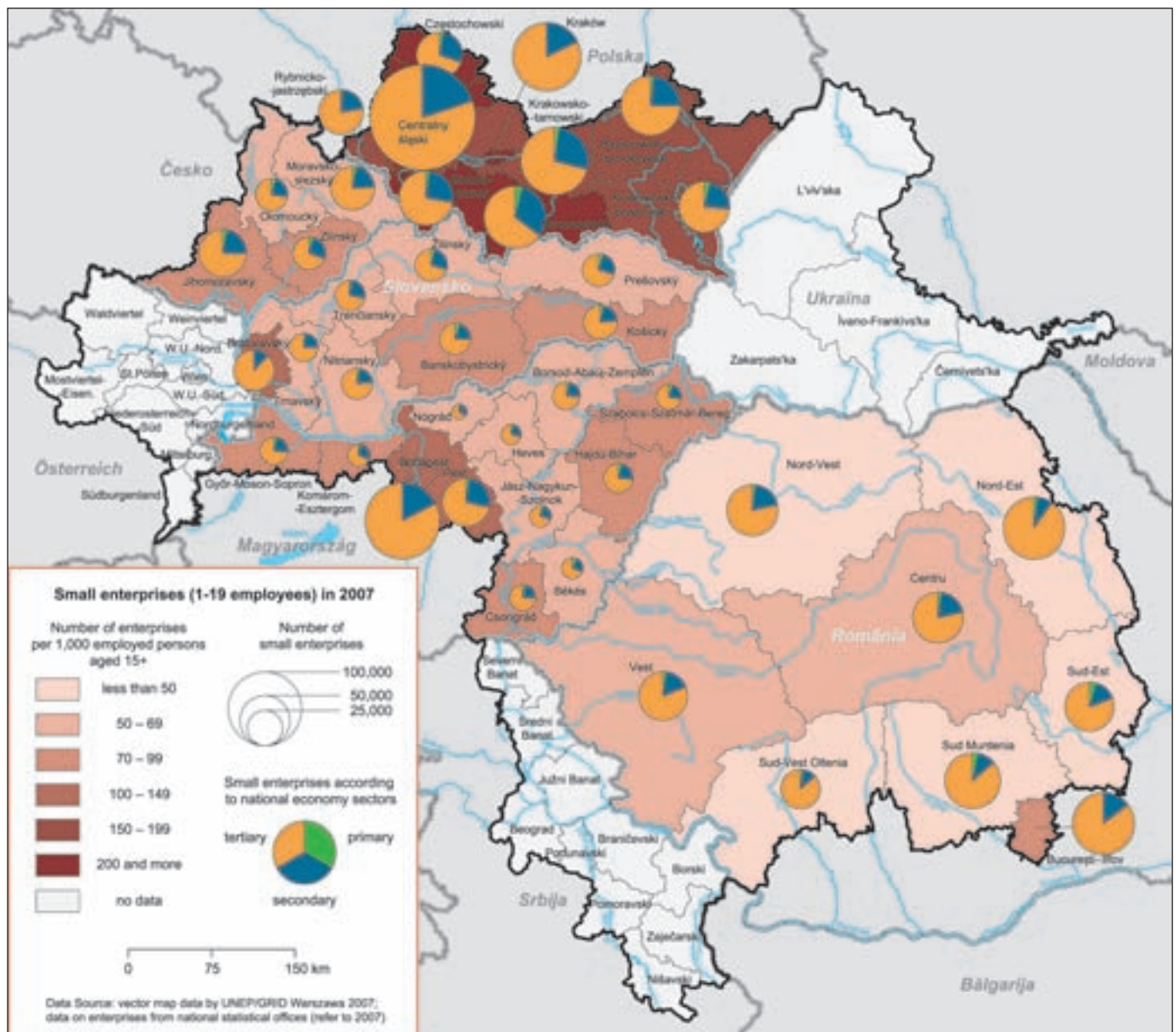


Fig. 8: Small enterprises in 2007  
Source: Atlas of the Carpathian Macroregion

Russia, crossing the main Carpathian chain in the Transcarpathian region of Ukraine and reaching Hungary, Slovakia and the Czech Republic. The Druzhba pipeline remains the most important source for oil supply in the region. The northern branch of the Druzhba pipeline is situated on the territory of Poland. Alternative sources of oil supply are situated between ports of the Adriatic and Black Seas (at Odesa, Constanța, Rijeka and Trieste) and target countries – Adriatic, AWP, Janaf. The most important project in the Carpathian region at present is the connection between the Janaf pipeline from Serbia to Constanta (Nabucco).

Gas pipelines also contribute to the strategic importance of the Carpathian Macroregion, with Transcarpathia being

the most important gas pipeline hub in the region. The pipelines almost exclusively connect Russia with the region of Central and Western Europe.

#### Waterways

The most important waterway in the region is the Danube, with important branch waterways of Tisza and Körös in Hungary and Serbia. The Danube crosses the Carpathian chain at the natural park Porțile de Fier/national park Đerdap at the border of Romania and Serbia.

#### Railways

The development of the railway network in the region is tightly connected with the industrialisation processes in the latter half of 19th century and first half of 20th

century. In the Carpathian area we can clearly see the consideration of a north-west-southeast gradient. Another factor is morphology and the presence of the Carpathian Mountains. The Carpathian mountain chain represents a traffic barrier particularly for the railway. The regions with the densest railway network are situated in the metropolitan areas of southern Poland, Vienna in Austria, Budapest in Hungary and in the Czech Republic. The areas with the lowest density of railway network (and least accessibility) are found in Ukraine, northern Slovakia and most of Romania, with exception of the Banat lowland and metropolitan area of Bucharest (București, Ilfov, Prahova). Most railways crossing the Carpathian mountain chain connect the



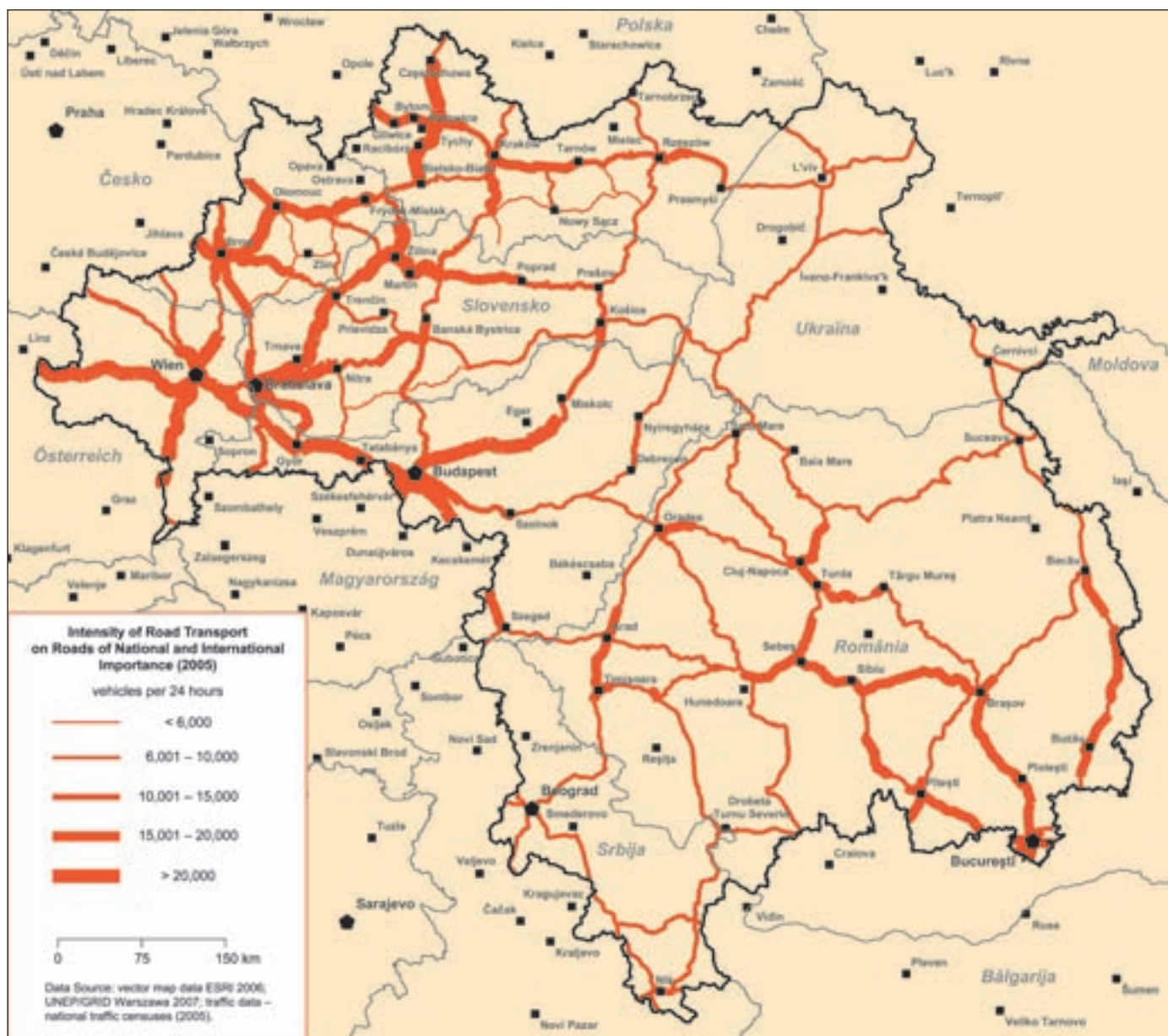


Fig. 9: Intensity of Road Transport 2005  
Source: Atlas of the Carpathian Macregion

Czech Republic and Slovakia and some are of European importance. There are also important railway crossings in Romania at Predeal and Porțile de Fier.

### Highways, international and regional roads

The highway network of the Carpathian Macregion is not well developed. The highest density, as well as the most accessible areas, are in the metropolitan areas of the largest cities (Vienna, Budapest, Katowice, Bratislava and Beograd). Elsewhere, a relatively high density exists in the Czech Republic at Jihomoravský kraj. No highways cross the main Carpathian ridge. The longest highway within the inner Carpathians is in Slovakia along the Váh river valley and is an important

route for improving the accessibility of the area for economic activities.

### Road transport intensity

Road transport plays the most important role for transportation systems of all countries in the Carpathian Macregion, in terms of volume and intensity for both freight and passenger transit. Evaluation of road transport intensity is focused on roads of national and international importance. With the exception of Serbia and Ukraine, comparable data for the other six Carpathian countries through the road transport census of 2005 are available. The volume of transport is expressed in the total average number of cars passing per 24 hours at selected sections of a particular highway

or road. The highest road transport intensity corresponds with the largest metropolitan areas of the region. The region with the highest intensity per 24 hours is Vienna and its metropolitan area with total intensities exceeding 65,000 vehicles per 24 hours in the Vienna sections of the A1, A2, A4, A22 and A23 motorways. The most dense section in Austria is the A23 in the area of Prater in Vienna (164,000 vehicles per 24 hours). In general, road transport intensity is achieving the highest numbers in Austria, followed by the main backbone road transport axis of the Czech Republic.

### Transborder Cooperation

Transborder cooperation addresses common interests across frontiers between

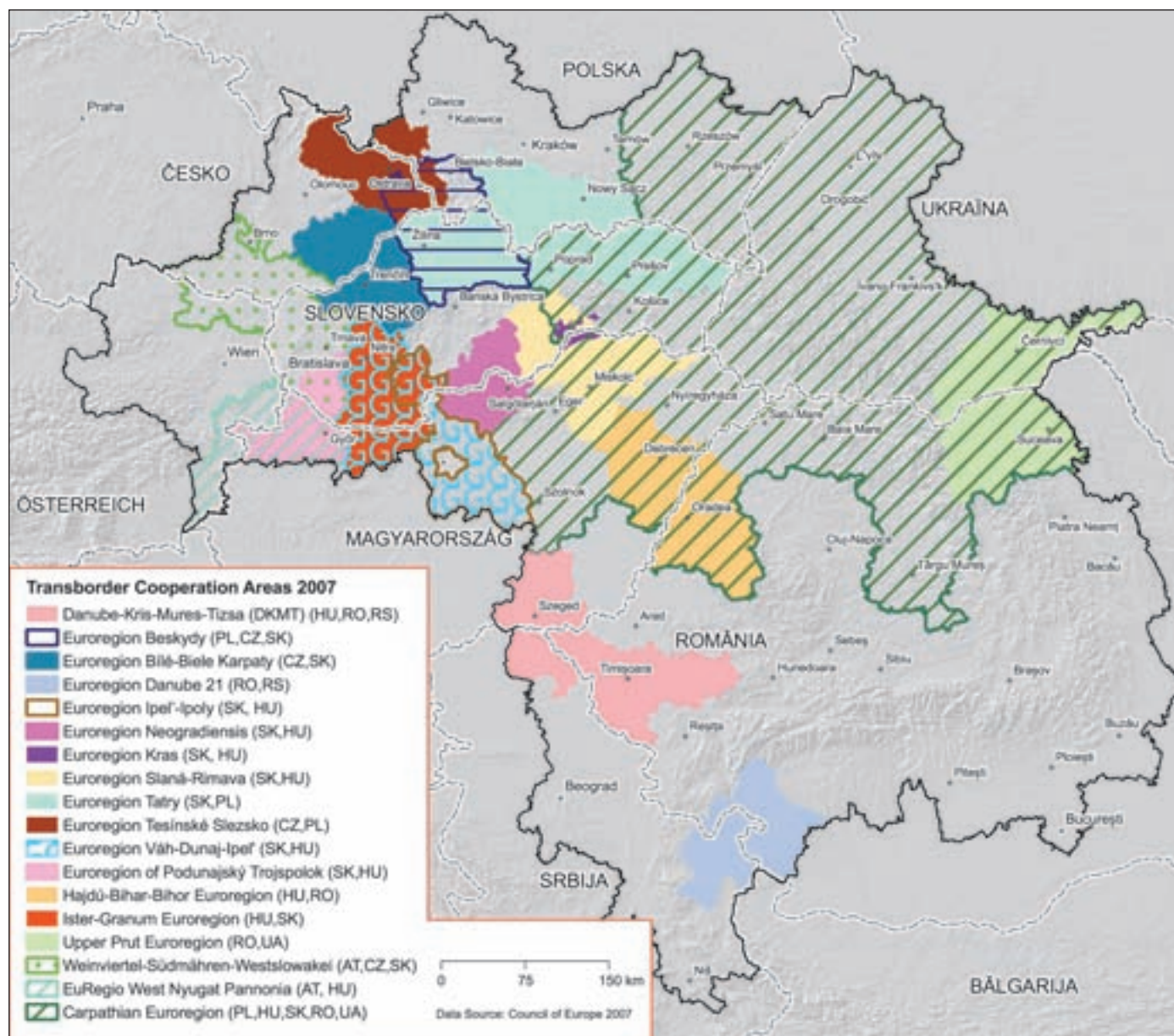


Fig. 10: Transborder Cooperation Areas 2007  
Source: Atlas of the Carpathian Macroregion

two or more countries. Unlike other European cooperative measures implemented on a national level, in Euroregions regional and local governments collaborate directly. Cooperative actions are implemented in defined transborder cooperation areas or Euroregions. Euroregions, which are identified by the Association of European Border Regions (AEBR) on the basis of certain criteria, aim to support regional development, investment in economy and tourism, and the protection of cultural and natural heritage on both sides of the border. Both economic growth and cultural activities are supported through the exchange of information and knowledge, and lobbying for issues in the common interest. Border areas are often richer in their natural environment due to their isolated

location, and they are culturally richer than other parts of the country because of a long tradition of crossborder trading. Cross-border initiatives aim to protect those cultural landscapes and their biodiversity. In many areas in order to activate cross-border cooperation the quality of transborder infrastructure needs to be improved. Often the aim of Euroregions is to initiate the creation of a common economic space.

There has been an increasing level of transnational cooperation in the last ten years in the Carpathians. Figure 10 shows Euroregions within the Carpathian Macroregion. Not shown are Euroregions where Carpathian countries collaborate with non-Carpathian countries. There are 18 Euroregions in total in the Carpathian Macroregion. Slovakia and

Hungary are partners in seven Euroregions along their common border alone.

Most of the Euroregions aim to improve regional development and in many cases the focus is on economic and in particular touristic development. The Euroregion Weinviertel-Südmähren-Westslowakei comprises a total of 270 municipalities in three NUTS3 regions on the border of Austria, the Czech Republic and Slovakia. Areas within this Euroregion share similar geographic characteristics and can thus offer a common type of tourism industry concentrating on wine tourism and national parks. Other for the Euroregion important economic factors are regional production networks including joint initiatives in metal production, the automotive industry and environmental technologies. The



Euroregion Danube-Kris-Mures-Tisza (DKMT), as another example, sees itself as a "Citizenship Euroregion". It aims at strengthening the public-private partnership at the level of cross-border institutions. Here representatives from Romanian, Serbian and Hungarian parts of the Euroregion consider non-governmental organisations as part of a common strategy for strengthening the public-private partnership at the level of cross-border institutions. The largest Euroregion, encompassing the most countries is the Carpathian Euroregion.

First discussions of local and regional leaders of the five neighbouring countries (Poland, Hungary, Romania, Slovakia, Ukraine) on how to enhance cross-border cooperation in the Carpathian Mountains began in 1992. A proclamation creating the Carpathian Euroregion was signed in 1993. Thus the first such Euroregion in Central and Eastern Europe came into existence. The Carpathian Foundation was set up as a coordinating body to promote inter-governmental cooperation as well as cooperation among citizen through the NGO sector.

## Conclusion

The Carpathians are Europe's largest range of mountains. They represent a unique natural treasure of great beauty and ecological value, and are home of the headwaters of major rivers. The Carpathians are an important reservoir for biodiversity, and Europe's last refuge for large mammals – brown bear, wolf, and lynx, home to populations of European bison, moose, wildcat, chamois, golden eagle, eagle owl, black grouse, plus any unique insect species.

Moreover the Carpathian region constitutes an important ecological, economic, cultural, recreational and living environment in the heart of Europe, shared by numerous peoples and countries. Although this region is characterised by a relatively high unemployment and emigration, it offers considerable tourism potential and hence numerous business opportunities.

The Atlas of the Carpathian Macrorregion was prepared by Palacký University in Olomouc and the European Academy of Bolzano in the framework of the Carpathian Project financed in the INTERREG III B CADSES Programme and follows the Publication on the Implementing an international mountain convention, that was elaborated with a

great support of the Italian Ministry for the Environment, Land and Sea. It describes the Carpathian space, the region of economic, social and environmental progress and sustainability in the heart of Europe. The atlas represents an extensive harmonised database focused primarily on the socio-economic aspects of the Carpathian space. It presents the region's advantages and potentials, and addresses the challenges of region in an innovative and coordinated manner.

The Atlas of the Carpathian Macrorregion contributes to the overall analysis of the Carpathian region and facilitates the implementation of the Carpathian Convention by the policy makers. In addition, the Atlas of the Carpathian Macrorregion represents a tool helping to develop the follow-up activities in the Carpathian space providing comprehensive and concise information base for areas such as population development, tourism development, cultural heritage, transborder cooperation etc.

## References

- AEBR (2007) Map – Crossborder Cooperation Areas 2007.
- BANSKI, J. (2002): Land management in Poland in the period of transformation. In: HELMING, K., H. WIGGERING (eds.): Sustainable Development of Multifunctional Landscapes, pp. 217-227.
- BECKER, G. (1993): Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education. 3. vydání. Chicago.
- BIRN (2006): "Eastern Serbia Dies Slow Death from Depopulation", online: <http://www.birn.eu.com/en/95/10/3719/> (downloaded on October 2007).
- BLASCHKE, J. (ed.) (2004): Migration and Political Intervention. Diasporas in Transition Countries. Edition Parabolis.
- BRITISH GEOLOGICAL SURVEY (2007): World Mineral Production 2002-2006. London.
- BURGER, A. (2001): Agricultural development and land concentration in a central European country: a case study of Hungary. In: Land Use Policy, No. 3, Vol. 18, pp. 259-268.
- CARPATHIAN FOUNDATION (2002): Annual Report 2002'. Online: [http://www.carpathianfoundation.org/cf/uploadedFiles/webfiles/cfile\\_12\\_8\\_04\\_9\\_13\\_55\\_PM.pdf](http://www.carpathianfoundation.org/cf/uploadedFiles/webfiles/cfile_12_8_04_9_13_55_PM.pdf) (downloaded on February 2008).
- CSAKI, C., Z. LERMAN (2001): Land and Farm Structure in Poland. Discussion Paper No. 10.01. Hebrew University, Jerusalem.
- CZECH STATISTICAL OFFICE (2007): Small and medium sized enterprises. data based on 2001 Census. Internal database of CZSO.
- DOMANSKI, B. (2000): The Impact of Spatial and Social Qualities on the Reproduction of Local Economic Success: the Case of the Path Dependent Development of Gliwice. In: Prace Geograficzne 106, pp. 35-53. Online: [www.geo.uj.edu.pl/zaklady/zrr/publikacje/pdf/Domanski%20Gliwice.pdf](http://www.geo.uj.edu.pl/zaklady/zrr/publikacje/pdf/Domanski%20Gliwice.pdf) (downloaded on February 2008).
- ELBAKIDZE M., P. ANGELSTAM (2007): Implementing sustainable forest management in Ukraine's Carpathian Mountains: The role of traditional village systems. In Forest Ecology and Management 249, pp. 28-38.
- ENCARTA ENCYCLOPEDIA (1999): Carpathians, definition, ed. Microsoft.
- ENTRANS (2006): Regional Economic Analysis of the Republic of Serbia. Online: [www.entranse.org/Administration/Download/en-US/Programme%20-%20Regional%20Analysis.pdf](http://www.entranse.org/Administration/Download/en-US/Programme%20-%20Regional%20Analysis.pdf) (downloaded on February 2008).
- ESPON (2007): Intensity of transnational INTERREG cooperation. Map.
- EUROPEAN PARLIAMENT regulation No. 696/1993.
- EUROPEAN UNION COUNCIL regulation No. 177/2008.
- EUROSTAT (2006): Regions-statistical yearbook (data 2000-2004). Chapter 11, pp. 145-165.
- EUROSTAT (2007): Key data on higher education in Europe, 2007 Edition. Luxembourg.
- EUROSTAT PORTRAITS (2003 and 2004): Online: <http://circa.europa.eu/irc/dsis/regportraits/info/data/en/index.htm> (downloaded on February 2008).
- EUROSTAT, GISCO DATABASE MANUAL (2003): Online: [http://eusoiils.jrc.it/gisco\\_dbm/nr/ls/dbm/nrls.htm](http://eusoiils.jrc.it/gisco_dbm/nr/ls/dbm/nrls.htm) (downloaded in December 2007).
- FERANEC et al. (2000): Inventory of major landscape changes in the Czech Republic, Hungary, Romania and Slovak

- Republic 1970s-1990s. In: JAG, vol. 2, pp. 129-140.
- HALL, D. (2005): Sustainable Rural Tourism and Rural Change. In: SCHMIED, D. (2005): Winning and losing. The Changing Geography of Europe's Rural Areas. Ashgate.
- HUNGARIAN ACADEMY OF SCIENCE (2007): 'Socio-economic analysis of the Carpathian area'. Pécs.
- HUNGARIAN ACADEMY OF SCIENCE (2008): Visions and strategies in the Carpathian area (VASICA). Pécs.
- HUNGARIAN STATISTICAL OFFICE: Business demography, Hungary. Active enterprises 2005. Internal database of HSO.
- ICOMOS (2000): H@R!: Heritage at Risk – Romania. Online: [http://www.international.icomos.org/risk/roman\\_2000.htm](http://www.international.icomos.org/risk/roman_2000.htm).
- INTERNATIONAL AGENCY ENERGY (2007): Energy Statistics of OECD Countries 2004-2006.
- KOUČKÝ, J., A. BARTUŠEK, J. KOVAŘOVIC (2007): Inequality and Access to Tertiary Education: European Countries 1950-2005 Working paper. Charles University. Prague.
- LERMAN, Z., K. BROOKS, C. CSAKI (1994): Land reform and farm restructuring in Ukraine. World Bank Discussion paper No. 270. Washington.
- MCCRONE, D., R. KIELY (2000): Nationalism and Citizenship. In: Sociology, vol. 34, no. 1, pp. 19-34.
- MONTHEL, J., P. VADALA, J.M. LEISTEL, F. COTTARD (2002): Mineral deposits and mining districts of Serbia. Compilation map and GIS databases. BRGM/RC-51448-FR.
- OECD (2004): Education at a glance 2004 – Tables (online). Dostupné z [www.oecd.org/dataoecd/52/41/33668656.xls](http://www.oecd.org/dataoecd/52/41/33668656.xls) (cit.10-29-2007).
- OECD (2007): Education at a glance 2007. OECD Indicators. Paris, OECD Publishing.
- PERMANENT SECRETARIAT OF THE ALPINE CONVENTION (2006): Report on the State of the Alps 2006 – Transport and Mobility in the Alps.
- PICHLER, N. MILANOVIĆ (2005): Urban Development in Central and Eastern Europe: from transition to "creative" competition, 41st IsoCaRP Congress, Bilbao, Spain, 17-20 October 2005. Online: [www.isocarp.net/Data/case\\_studies/585.pdf](http://www.isocarp.net/Data/case_studies/585.pdf) (downloaded on March 2008).
- POLISH STATISTICAL OFFICE (2007): Number of small and medium sized enterprises. Internal database of PSO.
- PTÁČEK, P., F. RUFFINI, V. (eds.) (2009): Atlas of the Carpathian Macroregion. Palacký University Olomouc, Viktor Hořín – EPAVA, Olomouc.
- RICHARDS, J. (2005): Rosia Montana gold controversy. Mining Environmental management, 1/2005. London: Mining Communications Limited, pp. 5-13.
- ROMANIAN STATISTICAL OFFICE (2007): Number of active companies in 2007. Internal database of RSO.
- RUSU, M., V. PAMFIL (2007): Agricultural land reform and land consolidation in Romania.
- SLOVAK STATISTICAL OFFICE (2007): Number of small and medium sized enterprises Internal database of SSO.
- SOLOW, R.M. (1956): A Contribution to the Theory of Economic Growth. The Quarterly Journal of Economics, vol. 70, no. 1, pp. 65-94.
- STATISTICAL OFFICE OF SERBIA (2007): Municipalities in Serbia 2006, number of small and medium sized enterprises. Internal database of SSO. Belgrade.
- STATISTIK AUSTRIA (2004): Volkszählung. Hauptergebnisse II – Burgenland, Niederösterreich, Wien. Wien.
- SURVEY OF ENERGY RESOURCES (2007): World Energy Council. London.
- TÓTH, E. (2001): Characteristics of land ownership and land utilization structure ten years later economic-social changes in Hungary. In: Agricultural Economics – Zemědělská ekonomika, no. 7, vol. 47. ÚZPI, Praha, pp. 322-326.
- TUČEK, M. et al. (2003): Dynamika české společnosti a osudy lidí na přelomu tisíciletí. Praha.
- UNDP COUNTRY OFFICE IN SERBIA (2006): Human Development Indicators. Online: [www.undp.org.yu/tareas/reports/reports\\_dl.cfm?id=91](http://www.undp.org.yu/tareas/reports/reports_dl.cfm?id=91) (downloaded on February 2008).
- UNEP (2007): Carpathians Environment Outlook 2007, UNEP/DEWA Europe.
- UNESCO (2006): International Standard Classification of Education ISCED 1997.
- UNESCO (2007): Online: <http://whc.unesco.org/en/list>.
- VARGA, G. (1996): Situace Maďarského zemědělství v přípravné fázi vstupu do EU. In: Zemědělská ekonomika, no. 10, vol. 42. ÚZPI, Praha, pp. 473-476.
- VUKOVIĆ, D. (2005): Migrations of the Labour Force from Serbia. In: South-East Europe Review 4, pp. 139-150.
- WDPA – WORLD DATABASE OF PROTECTED AREAS (2006): <http://www.wdpa.org/> (downloaded: October 2007).
- WEBER, L., G. ZSAK (eds.) (2003): World-Minig Data. Wien: Federal Ministry for Economy and Labour of the Republic of Austria.
- WHO Europe (2005): Highlights on Health in Ukraine. Online: <http://www.euro.who.int/document/e88285.pdf> (downloaded on February 2008).
- WORLD ENERGY COUNCIL (2002): Restructuring the Coal Industry: Central and Eastern Europe and the CIS.
- ZANOLLA, G., F. RUFFINI, T. STREIFENEDER (2007): Demographic dynamics in the Alpine arch: trends and future developments with special focus on Italy. Paper presented at the International Conference on Regional and Urban Modeling. Brussels.
- ŽÍTEK, V., J. KUNC, P. TONEV, (2006): Vybrané indikátory regionální konkurenceschopnosti a jejich vývoj. Working paper č. 21. Brno, Centrum výzkumu konkurenční schopnosti české ekonomiky.

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